

# NPN SILICON GERMANIUM RF TRANSISTOR

# NESG2021M16

### NPN SiGe RF TRANSISTOR FOR LOW NOISE, HIGH-GAIN AMPLIFICATION 6-PIN LEAD-LESS MINIMOLD (M16, 1208 PKG)

#### FEATURES

- The device is an ideal choice for low noise, high-gain at low current amplifications  
 $NF = 0.9 \text{ dB TYP.}, G_a = 18.0 \text{ dB TYP. @ } V_{CE} = 2 \text{ V}, I_C = 3 \text{ mA}, f = 2 \text{ GHz}$   
 $NF = 1.3 \text{ dB TYP.}, G_a = 10.0 \text{ dB TYP. @ } V_{CE} = 2 \text{ V}, I_C = 3 \text{ mA}, f = 5.2 \text{ GHz}$
- Maximum stable power gain:  $MSG = 22.5 \text{ dB TYP. @ } V_{CE} = 3 \text{ V}, I_C = 10 \text{ mA}, f = 2 \text{ GHz}$
- High breakdown voltage technology for SiGe Tr. adopted:  $V_{CEO}$  (absolute maximum ratings) = 5.0 V
- 6-pin lead-less minimold (M16, 1208 PKG)

#### <R> ORDERING INFORMATION

Part Number	Order Number	Package	Quantity	Supplying Form
NESG2021M16	NESG2021M16-A	6-pin lead-less minimold (M16, 1208 PKG) (Pb-Free)	50 pcs (Non reel)	<ul style="list-style-type: none"> <li>8 mm wide embossed taping</li> <li>Pin 1 (Collector), Pin 6 (Emitter) face the perforation side of the tape</li> </ul>
NESG2021M16-T3	NESG2021M16-T3-A		10 kpcs/reel	

**Remark** To order evaluation samples, please contact your nearby sales office.  
Unit sample quantity is 50 pcs.

#### ABSOLUTE MAXIMUM RATINGS ( $T_A = +25^\circ\text{C}$ )

Parameter	Symbol	Ratings	Unit
Collector to Base Voltage	$V_{CBO}$	13.0	V
Collector to Emitter Voltage	$V_{CEO}$	5.0	V
Emitter to Base Voltage	$V_{EBO}$	1.5	V
Collector Current	$I_C$	35	mA
Total Power Dissipation	$P_{tot}^{\text{Note}}$	175	mW
Junction Temperature	$T_j$	150	$^\circ\text{C}$
Storage Temperature	$T_{stg}$	-65 to +150	$^\circ\text{C}$

**Note** Mounted on  $1.08 \text{ cm}^2 \times 1.0 \text{ mm}$  (t) glass epoxy PCB

**Caution** Observe precautions when handling because these devices are sensitive to electrostatic discharge.

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Not all products and/or types are available in every country. Please check with an NEC Electronics sales representative for availability and additional information.

**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = +25°C)**

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
<b>DC Characteristics</b>						
Collector Cut-off Current	I <sub>CB0</sub>	V <sub>CB</sub> = 5 V, I <sub>E</sub> = 0 mA	–	–	100	nA
Emitter Cut-off Current	I <sub>EB0</sub>	V <sub>EB</sub> = 1 V, I <sub>C</sub> = 0 mA	–	–	100	nA
DC Current Gain	h <sub>FE</sub> <sup>Note 1</sup>	V <sub>CE</sub> = 2 V, I <sub>C</sub> = 5 mA	130	190	260	–
<b>RF Characteristics</b>						
Gain Bandwidth Product	f <sub>T</sub>	V <sub>CE</sub> = 3 V, I <sub>C</sub> = 10 mA, f = 2 GHz	20	25	–	GHz
Insertion Power Gain	S <sub>21e</sub>   <sup>2</sup>	V <sub>CE</sub> = 3 V, I <sub>C</sub> = 10 mA, f = 2 GHz	17.0	19.0	–	dB
Noise Figure (1)	NF	V <sub>CE</sub> = 2 V, I <sub>C</sub> = 3 mA, f = 2 GHz, Z <sub>S</sub> = Z <sub>Sopt</sub> , Z <sub>L</sub> = Z <sub>Lopt</sub>	–	0.9	1.2	dB
Noise Figure (2)	NF	V <sub>CE</sub> = 2 V, I <sub>C</sub> = 3 mA, f = 5.2 GHz, Z <sub>S</sub> = Z <sub>Sopt</sub> , Z <sub>L</sub> = Z <sub>Lopt</sub>	–	1.3	–	dB
Associated Gain (1)	G <sub>a</sub>	V <sub>CE</sub> = 2 V, I <sub>C</sub> = 3 mA, f = 2 GHz, Z <sub>S</sub> = Z <sub>Sopt</sub> , Z <sub>L</sub> = Z <sub>Lopt</sub>	15.0	18.0	–	dB
Associated Gain (2)	G <sub>a</sub>	V <sub>CE</sub> = 2 V, I <sub>C</sub> = 3 mA, f = 5.2 GHz, Z <sub>S</sub> = Z <sub>Sopt</sub> , Z <sub>L</sub> = Z <sub>Lopt</sub>	–	10.0	–	dB
Reverse Transfer Capacitance	C <sub>re</sub> <sup>Note 2</sup>	V <sub>CB</sub> = 2 V, I <sub>E</sub> = 0 mA, f = 1 MHz	–	0.1	0.2	pF
Maximum Stable Power Gain	MSG <sup>Note 3</sup>	V <sub>CE</sub> = 3 V, I <sub>C</sub> = 10 mA, f = 2 GHz	20.0	22.5	–	dB
Gain 1 dB Compression Output Power	P <sub>O</sub> (1 dB)	V <sub>CE</sub> = 3 V, I <sub>C (set)</sub> = 12 mA (RF OFF), f = 2 GHz, Z <sub>S</sub> = Z <sub>Sopt</sub> , Z <sub>L</sub> = Z <sub>Lopt</sub>	–	9	–	dBm
Output 3rd Order Intercept Point	OIP <sub>3</sub>	V <sub>CE</sub> = 3 V, I <sub>C (set)</sub> = 12 mA (RF OFF), f = 2 GHz, Z <sub>S</sub> = Z <sub>Sopt</sub> , Z <sub>L</sub> = Z <sub>Lopt</sub>	–	17	–	dBm

- Notes**
1. Pulse measurement: PW ≤ 350 μs, Duty Cycle ≤ 2%
  2. Collector to base capacitance when the emitter grounded
  3.  $MSG = \left| \frac{S_{21}}{S_{12}} \right|$

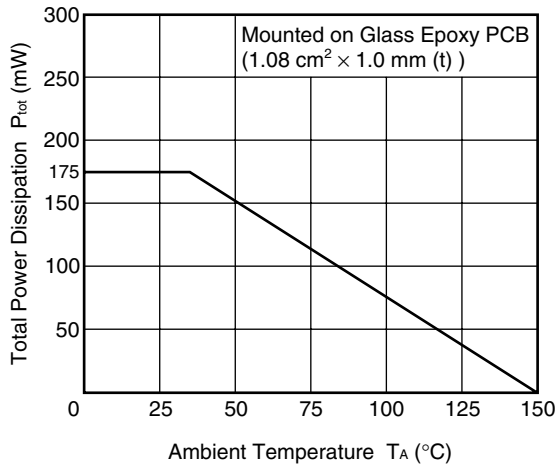
**h<sub>FE</sub> CLASSIFICATION**

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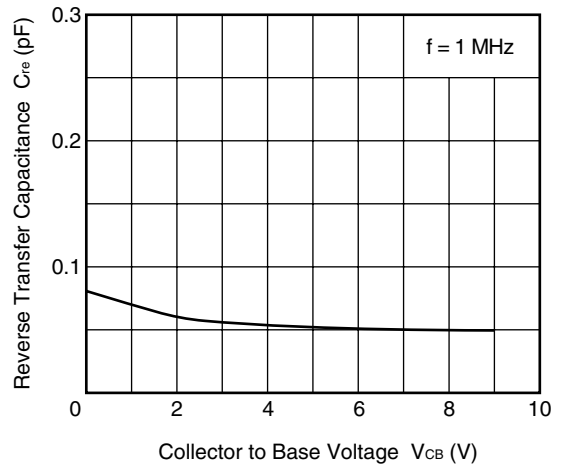
Rank	FB/YFB
Marking	zE
h <sub>FE</sub> Value	130 to 260

<R> **TYPICAL CHARACTERISTICS (T<sub>A</sub> = +25°C, unless otherwise specified)**

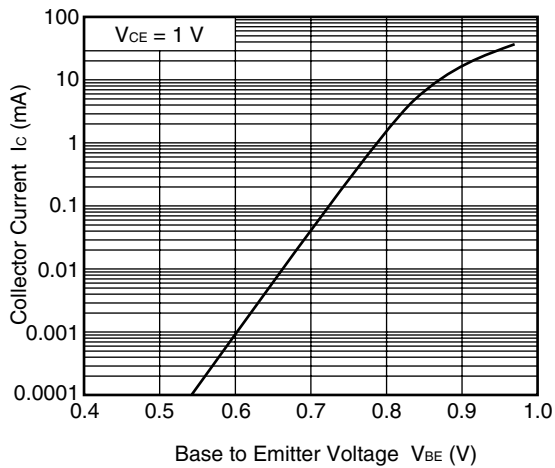
**TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE**



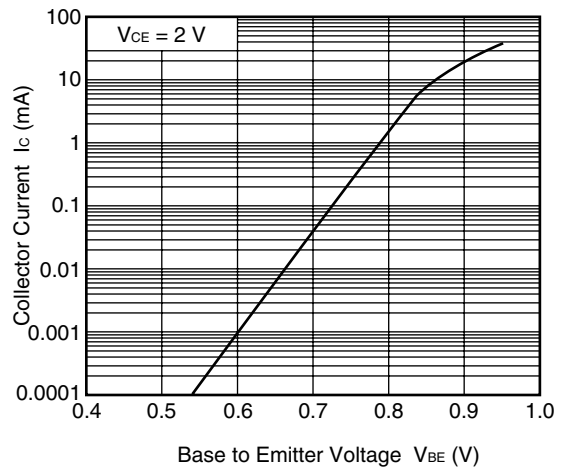
**REVERSE TRANSFER CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE**



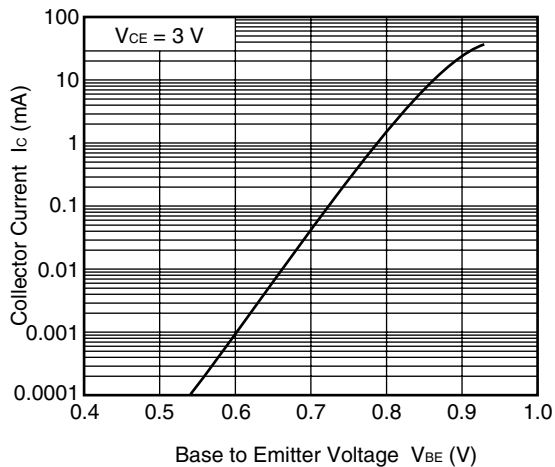
**COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE**



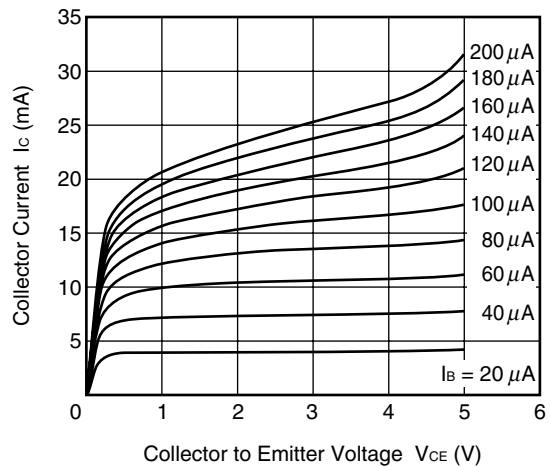
**COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE**



**COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE**

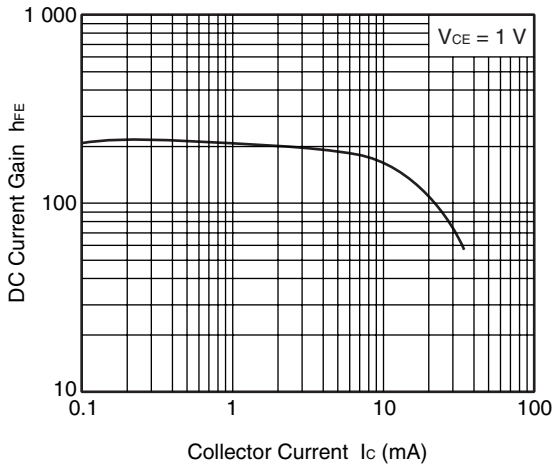


**COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE**

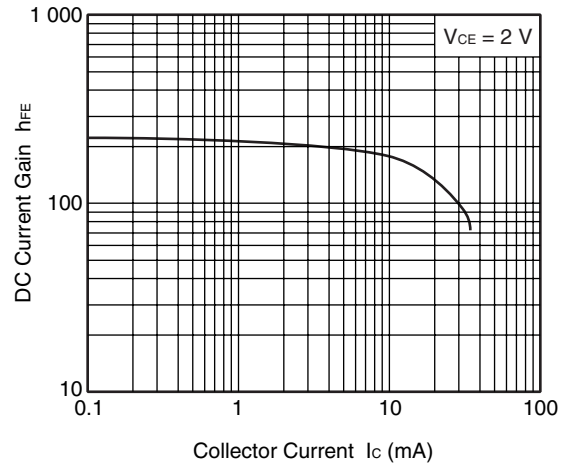


**Remark** The graphs indicate nominal characteristics.

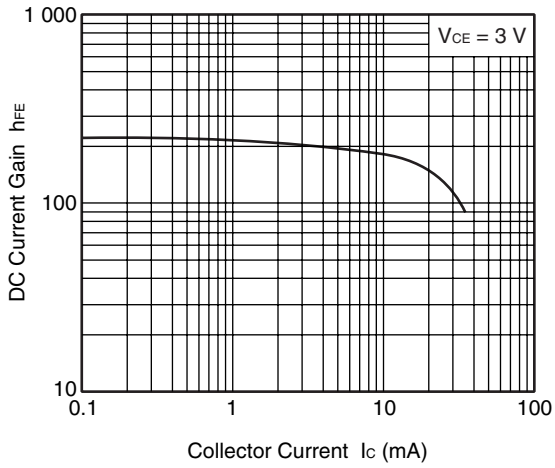
DC CURRENT GAIN vs. COLLECTOR CURRENT



DC CURRENT GAIN vs. COLLECTOR CURRENT

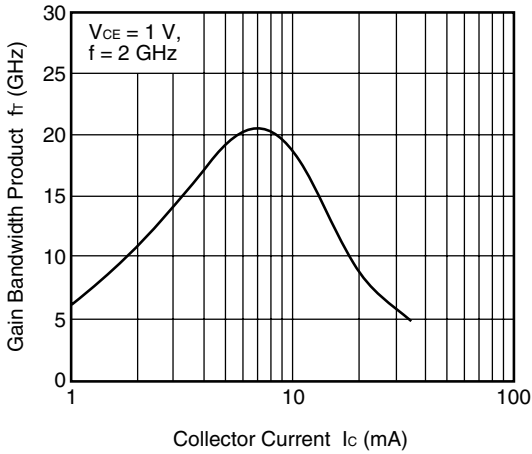


DC CURRENT GAIN vs. COLLECTOR CURRENT

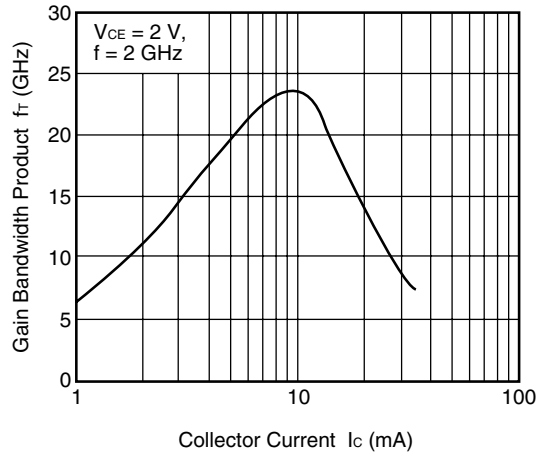


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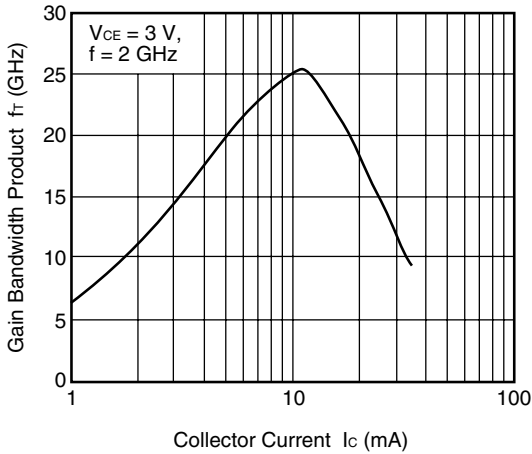
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



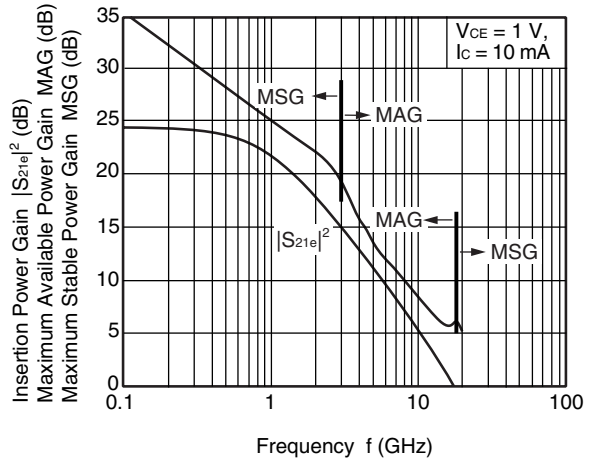
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



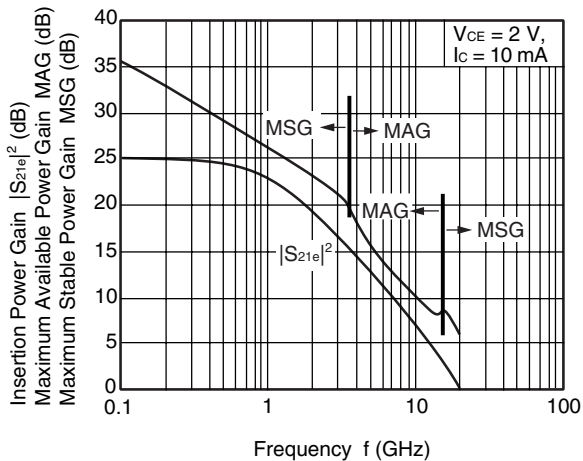
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



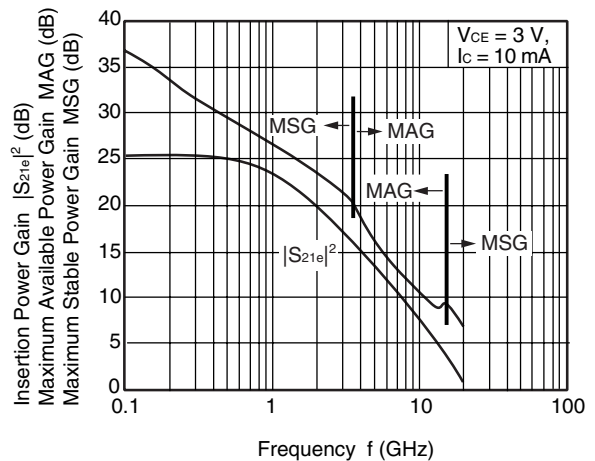
INSERTION POWER GAIN, MAG, MSG vs. FREQUENCY



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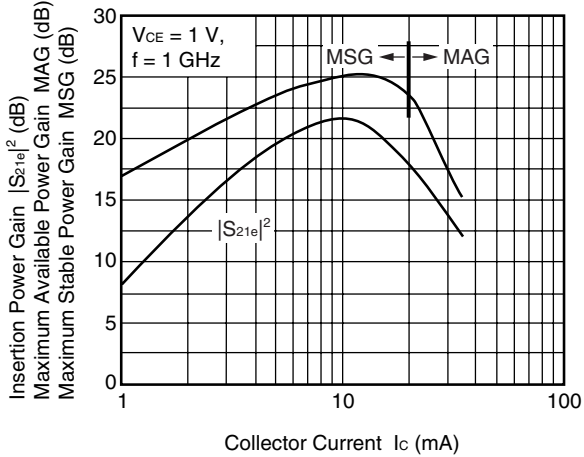


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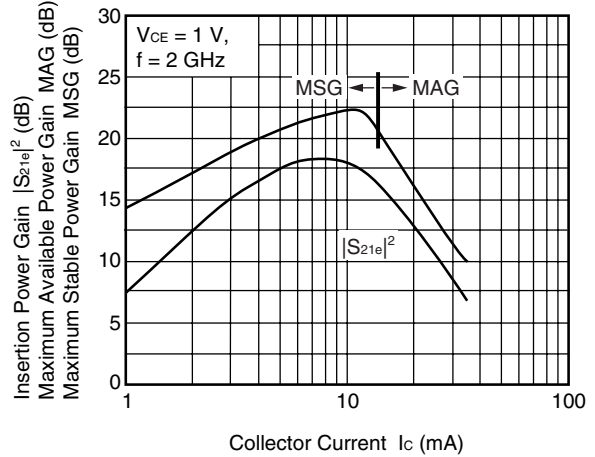


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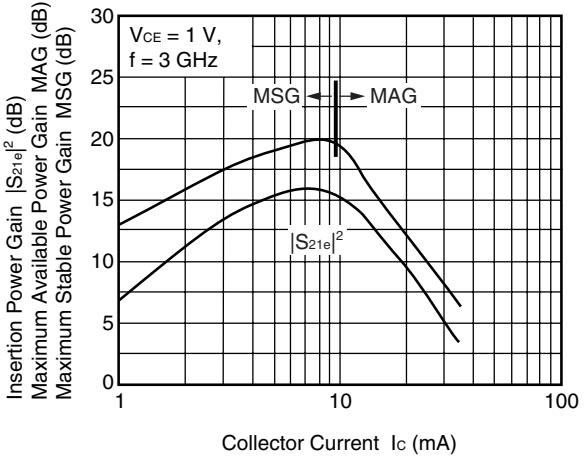
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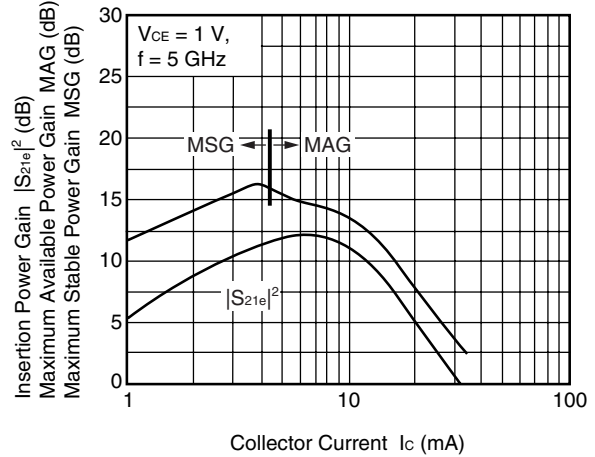
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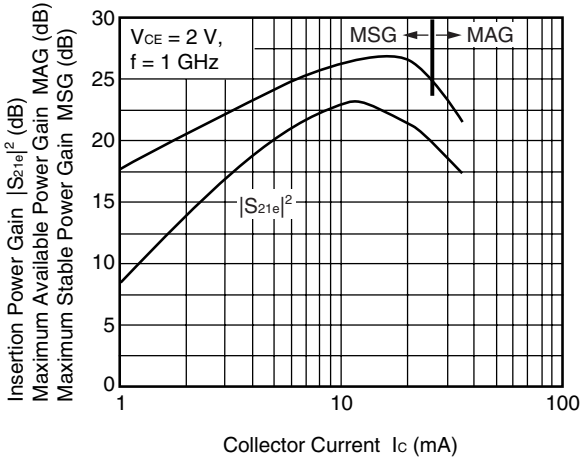
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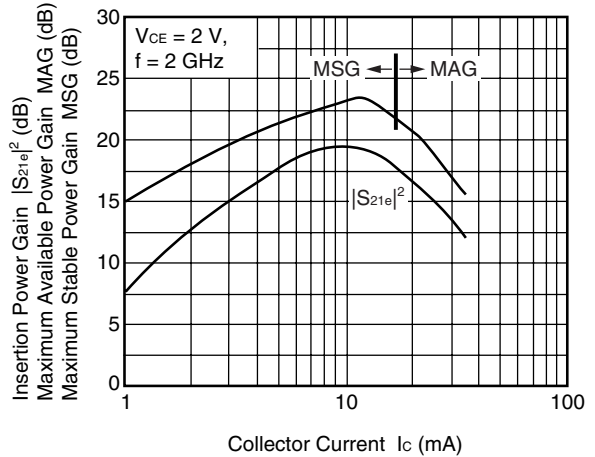
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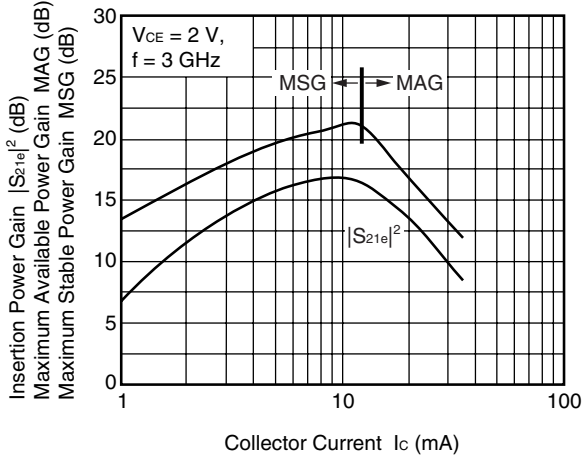


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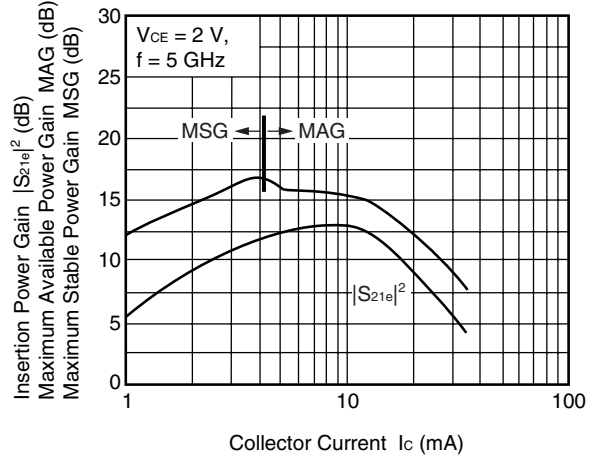


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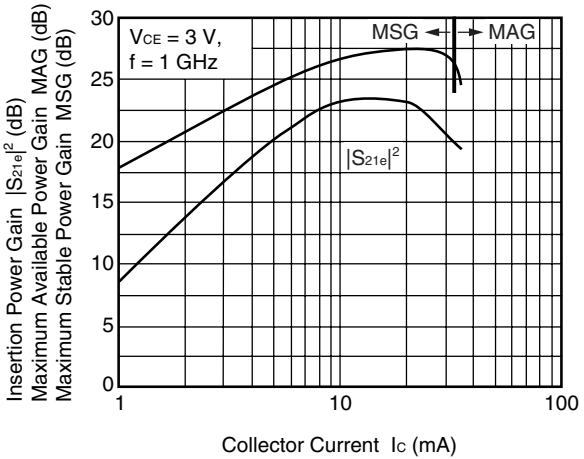
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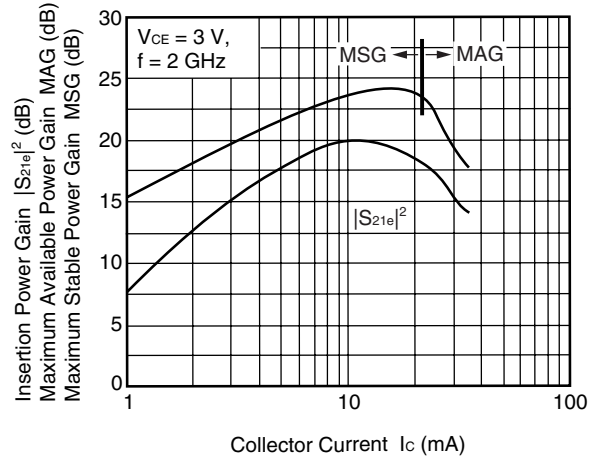
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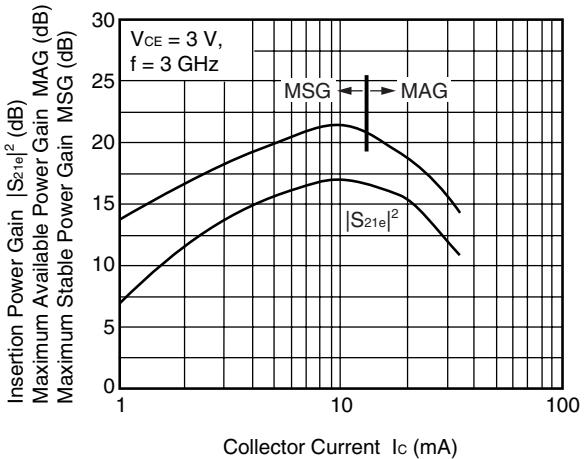
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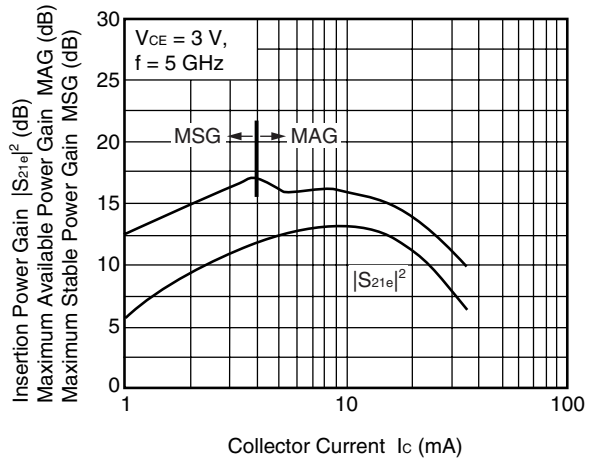
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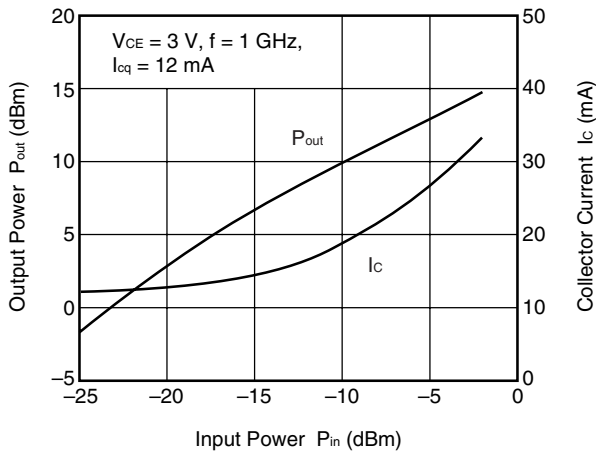


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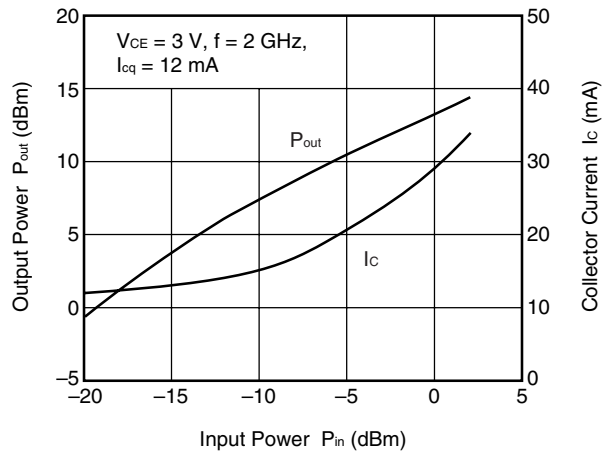


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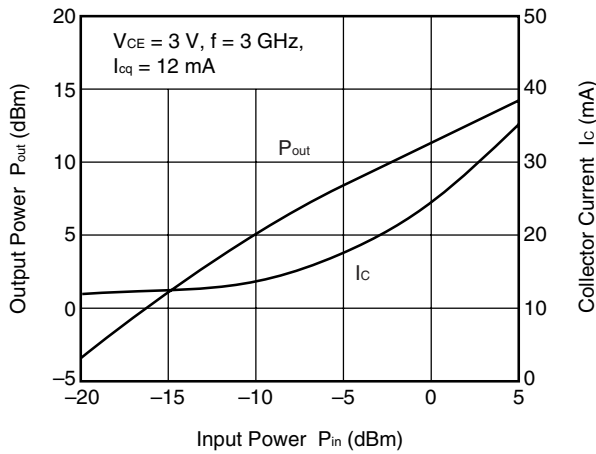
OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER



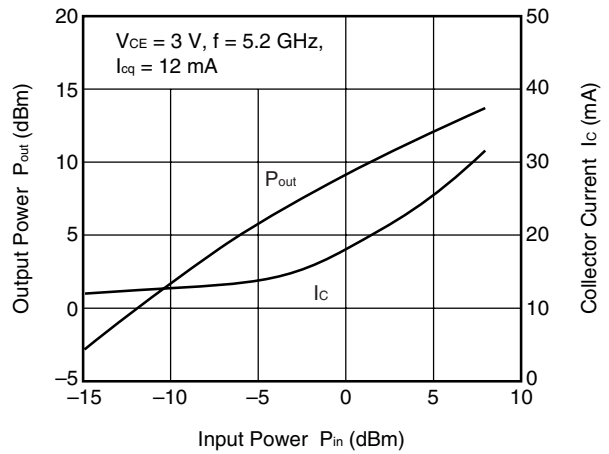
OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER



OUTPUT POWER, COLLECTOR CURRENT vs. INPUT POWER



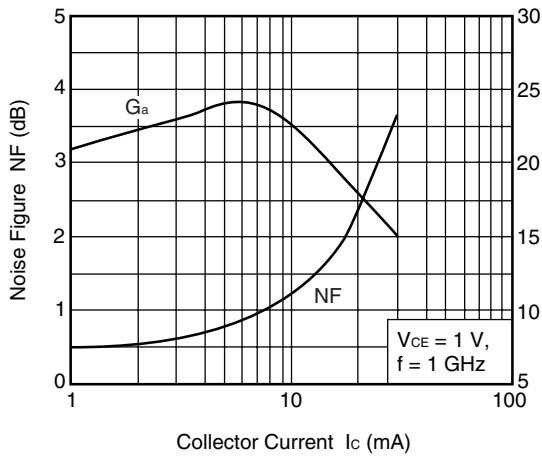
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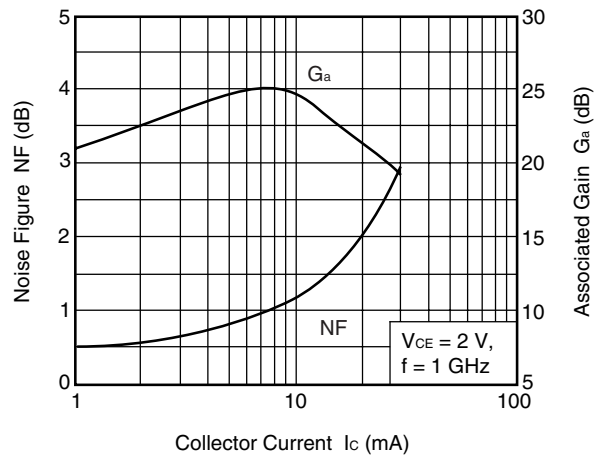
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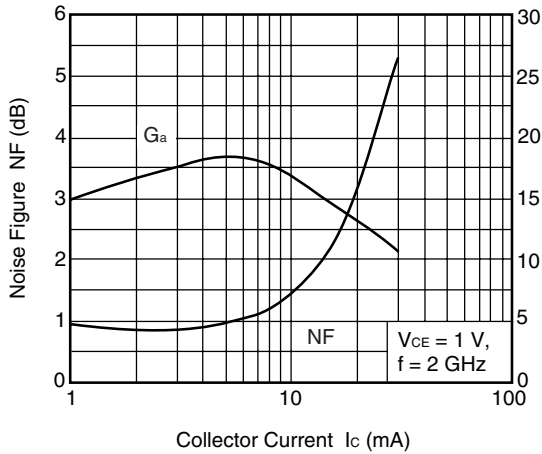
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



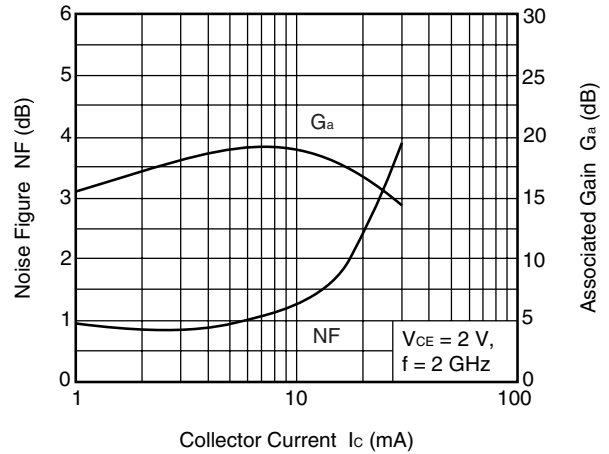
NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



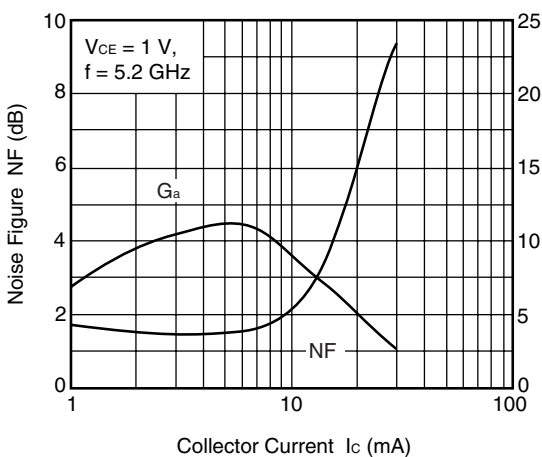
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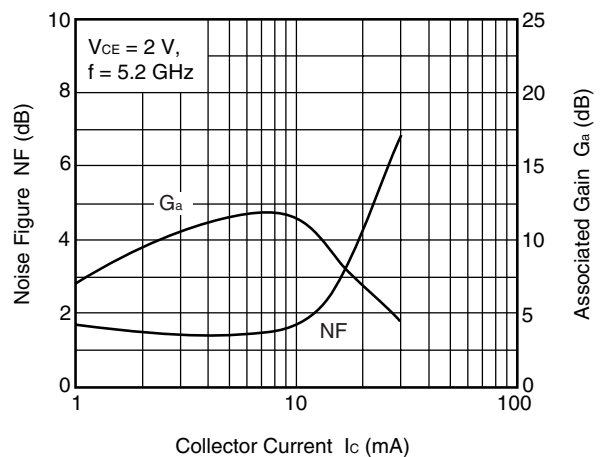
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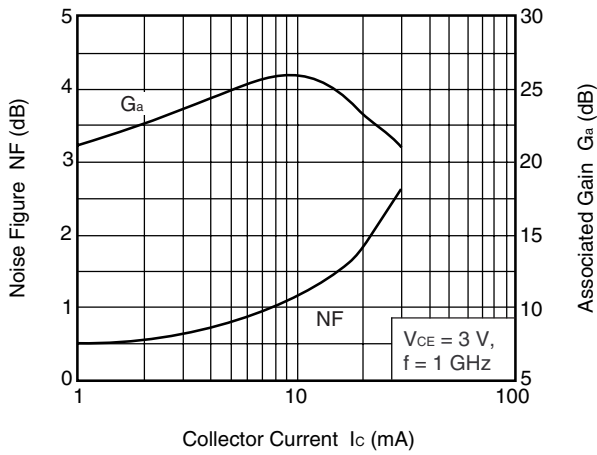


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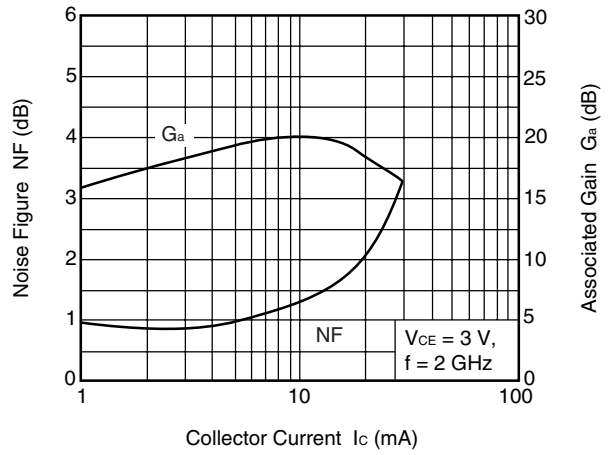


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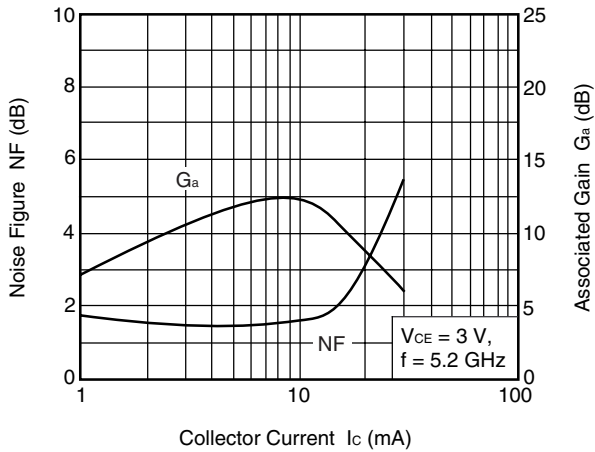
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NOISE FIGURE, ASSOCIATED GAIN vs. COLLECTOR CURRENT



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<R> **S-PARAMETERS**

S-parameters and noise parameters are provided on our Web site in a format (S2P) that enables the direct import of the parameters to microwave circuit simulators without the need for keyboard inputs.

Click here to download S-parameters.

[RF and Microwave] → [Device Parameters]

URL <http://www.necel.com/microwave/en/>



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